

Attorney Docket No.: 727-002c

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

-----X
In re application of
Serizawa
Examiner: Armando, Rodriguez
Serial No: 09/769,915
Art unit: 2828
Filed: January 25, 2001
For: CONTROL METHOD AND APPARATUS FOR STABILIZING OPTICAL
WAVELENGTH
-----X

RESPONSE TO OFFICE ACTION

Box No Fee

Honorable Assistant Commissioner of Patents
Washington, DC 20231

Dear Sirs:

AMENDMENT
REPLACEMENT PAGES

Applicant submits these replacement pages to accompany the amendment attached hereto
in response to the Office Action dated December 18, 2002.

Replacement Pages

17. An optical signal transmitter comprising:

a laser diode for outputting an optical signal to be transmitted;

a driving current source for driving said laser diode;

a plurality of control circuits each providing a control signal for controlling the optical wavelength of said laser diode in different control modes, wherein each control mode is based on different control parameters representing external conditions detected by said control circuits that cause a wavelength variation; and

a selector to select at least one of said control modes according to the status of electrical signals representing the external conditions of said laser diode, and to apply a control signals output from said selected control circuit to said laser diode, thereby achieving stabilizing control of optical wavelength with said selected control mode.

18. An optical signal transmitter comprising:

a laser diode for outputting an optical signal to be transmitted;

a driving current source for driving said laser diode;

a parameter deviation detector to detect a first control deviation of one parameter responsible for causing variations of optical wavelength output from said laser diode from a predetermined target value;

an optical wavelength deviation detector to detect a second control deviation of optical wavelength output from said laser diode from a predetermined target value;

a selector connected to said detectors so as to select either of said first and second control

deviations; and

a controller connected to the output of said selector and to the input of said laser diode to control one of said parameters so that said selected control deviation is reduced.

19. An optical signal transmitter according to claim 18, wherein one of said parameters is laser temperature.

20. An optical signal transmitter according to claim 18, wherein one of said parameters is driving current for driving said laser diode.

21. An optical signal transmitter according to claim 18, wherein said selector is constructed so as to select said second control deviation when said second control deviation is stably detected by said optical wavelength deviation detector, and to select said first control deviation when said second control deviation is not stably detected.

22. An optical signal transmitter comprising:

a laser module including a laser element, a temperature sensor and a cooling/heating element;

a first controller for stabilizing said optical wavelength;

a second controller for stabilizing said optical wavelength; and

a selector to select either of output signals from said first and second controllers according to the external conditions, so that stabilizing control of the optical wavelength of said

Replacement pages

laser element is performed according to the output signal from the selected controller, wherein:

said first controller comprises a temperature monitor coupled with said temperature sensor to monitor the temperature of said laser element detected by the temperature sensor, a first comparator coupled with said temperature monitor to detect the difference between the output value of the temperature monitor and a laser temperature control target value, and a first current controller coupled with said cooling/heating element to control the current flowing in the cooling/heating element according to an output signal from said first comparator, and

said second controller comprises an optical coupler arranged to split the output light from the laser module, an optical wavelength monitor coupled with said optical coupler to monitor the wavelength of the split output light, a second comparator coupled with said optical wavelength monitor to detect the difference between the monitored optical output wavelength value and a wavelength control target value, and a second current controller coupled with said cooling/heating element to control the current flowing in the cooling/heating element according to an output signal from said second comparator.

23. An optical signal transmitter according to claim 22, wherein said first and second current controller comprise a common current controller connected to said first and second comparators through said selector.

24. An optical signal transmitter according to claim 22, further comprising:
a delay circuit coupled with said selector so as to delay the current control of said cooling/heating element based on said selected controller by a predetermined time after either of

Replacement pages

said first and second controllers to be selected is determined.

25. A control apparatus for stabilizing the wavelength of light output from a laser element, comprising:

a plurality of control circuits for outputting control signals to control the optical wavelength of said laser element in respectively different control modes, wherein each control mode is based on different control parameters representing external conditions detected by said control circuits that cause a wavelength variation, and

selecting means for selecting at least one of control signals output from said control circuits according to the status of electrical signals representing the external conditions of said laser element, and applying the selected control signal to said laser element, thereby achieving stabilizing control of optical wavelength with said different control modes selectively according to the external conditions of said laser element.

26. A control apparatus for stabilizing optical wavelength according to claim 25, wherein, when said second control deviation is stably detected by said optical wavelength deviation detecting means, said selecting means selects said second control deviation, and when said second control deviation is not stably detected, said selecting means selects said first control deviation.

27. A control method for stabilizing the wavelength of light output from a laser element, comprising the steps of:

Replacement pages

selecting at least one of a plurality of control circuits, to output a control signal for controlling the optical wavelength of said laser element in respectively different control modes according to the status of external conditions of said laser element, wherein each control mode is based on different control parameters representing external conditions detected by said control circuit that cause a wavelength variation, and

applying a control signal output from said selected control circuit to said laser element, thereby achieving stabilizing control of optical wavelength with the control mode of said selected control circuit.

28. A method for stabilizing optical wavelength according to claim 27, wherein in said selecting step, when said second control deviation is stably detected in said optical wavelength deviation detecting step, said second control deviation is selected, and when said second control deviation is not stably detected in said optical wavelength deviation detecting step, said first control deviation is selected.